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OBLON SPIVAK MCCLELLAND MAIER & NEUSTADT PC  
FOURTH FLOOR  
1755 JEFFERSON DAVIS HIGHWAY  
ARLINGTON, VA 22202

EXAMINER

UHLIR, NIKOLAS J

ART UNIT	PAPER NUMBER
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1773

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9

Please find below and/or attached an Office communication concerning this application or proceeding.

TC-9

**Office Action Summary**

Application No.

09/871,896

Applicant(s)

IKEGAWA ET AL.

Examiner

Nikolas J. Uhler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_.

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-3, 6-7, 9-10, 12-13, and 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al. (US5474853) in view of Swisher (US5480730).

3. The limitations "formed on said substrate by sputtering, vacuum depositing or ion plating" and "obtained by molding a resin composition" in claim 1 are product-by-process limitations and do not appear to be further limiting in so far as the structure of the product is concerned. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP § 2113. In the instant case, the metal layer could have been formed by laminating a metal sheet and still meet all of the structural limitations of claim 1.

4. With respect to the limitations of claim 1, wherein the applicant requires a laminate comprising a metal layer which is deposited on a substrate, wherein the

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substrate is activated by plasma treatment, and the substrate comprises a resin composition containing 20-150 parts by mass of a fibrous filler having an average diameter of 0.1-5 $\mu$ m and an average length of 10-50 $\mu$ m relative to 100 parts by mass of the base resin. Watanabe et al. teaches a resin composition for producing a molded article, wherein the resin composition comprises a nylon resin, a modified polyphenylene ether resin, a fibrous inorganic filler having a specific average particle length/diameter, a powdery inorganic filler having a specific particle diameter, an epoxy resin, and a copper compound. This resin composition is molded into a desired shape and a metal layer is subsequently deposited on a surface of the molded resin. (Column 2, line 57-column 3, line 25). Suitable materials for the nylon resin include MX-nylons in combination with polyamide-66 (nylon-66) (column 3, lines 28-51). The fibrous inorganic filler is typically selected from potassium titanate whiskers, aluminum borate whiskers, titanium oxide whiskers, and glass fibers (column 5, lines 45-50). If selected, the potassium titanate whiskers have an average diameter between .1-5  $\mu$ m and an average fiber length between 1-100 $\mu$ m. If aluminum borate whiskers are selected, they have an average diameter less than 3 $\mu$ m and an average length between 10-100 $\mu$ m (column 6, lines 6-19). Although Watanabe et al. teaches length and diameter ranges that overlap the ranges required by the applicant in claim 1, the examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time to change the fiber and diameter within the range specified as suitable, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re*

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*Aller, 105 USPQ 233.* The resin composition taught by Watanabe et al. typically contains between 5-60 parts by weight of the fibrous filler, based on 100 parts by weight of the base resin (column 3, lines 10-15). If the amount of fibrous filler is less than 5 parts by weight, the strength and rigidity of the molded article is lowered. Conversely, if the amount of fibrous filler used is greater than 60% by weight, the reflection performance of the article is hindered. Thus, the examiner takes the position that the amount of fibrous filler used is a results effective variable, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the amount of filler within the specified range in order to achieve a balance between strength of the article and reflection performance. Lastly, the resin composition is molded, and a metal layer is deposited onto the molded resin via sputtering or vapor deposition. Suitable metals include aluminum, chromium, and nickel (column 9, lines 5-16).

5. Watanabe et al. does not teach a molded resin article that has had its surface activated by plasma treatment.

6. However, Swisher teaches that the adhesion of a metal layer to a resin material is improved if the surface of the resin is treated with a plasma prior to forming a thick metal layer on the resin (column 4, lines 3-14) via sputtering, vapor deposition, or electroless/electrolytic deposition (column 9, line 1-column 10, line 12). This treatment is suitable for resin materials including polyamides (nylons), polyesters, and polyphenylene ethers (column 6, lines 43-60), and is useful for enhancing the adhesion

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of metals such as aluminum, copper, gold, silver, etc... to these resins (column 7, lines 50-60).

7. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to treat the surface of the molded resin article taught by Watanabe et al. with a plasma prior to depositing a metal layer on the resin, as taught by Swisher.

8. One would have been motivated to make this modification due to the teaching in swisher that plasma treating resin materials enhances the adhesion of metal layers deposited on those resins by sputtering or vapor deposition, and the teaching in Swisher that the plasma treatment is suitable for the materials which are listed in Watanabe et al. (i.e. polyamides and aluminum)

9. Regarding the limitations of claim 2, wherein the applicant requires 1 or more resins having at least one bond or functional group selected from the group consisting of an amido bond, a sulfide group, a cyano group, an ester group, a sulfone group, a ketone group, and an imido group. Watanabe et al. teaches the use of MX-nylons in the resin material as stated above. Nylons are well known in the art to be polyamides, and thus necessarily contain an amido bond. Thus, the limitations of claim 2 are met.

10. Regarding the limitations of claim 3, wherein the applicant requires a resin selected from the group consisting of nylon 46, nylon 11, nylon 6-10, nylon 12, nylon 6, nylon 66, poly(phthalamide), polyphenylene sulfide, poly(ether) nitrile, polyethylene terephthalate, polybutylene terephthalate, polysulfone, polyethersulfone, poly ether ketone, poyetherimide, and melt-type liquid crystal polyester to be used in the base

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resin. Watanabe et al. teaches the use of polyamide 66 (Nylon 66) in the base resin as shown above for claim 1. Thus, the limitations of claim 3 are met.

11. Regarding the limitations of claim 6, wherein the applicant requires a titanate to be used as the fibrous filler. Watanabe et al. teaches the use of potassium titanate as shown above. Thus, the limitations of claim 6 are met.

12. Regarding the limitations of claim 7, wherein the applicant requires a borate to be used as the fibrous filler. Watanabe et al. teaches the use of aluminum borate as the fibrous filler as shown above for claim 1. Thus the limitations of claim 7 are met.

13. Regarding the limitations of claim 9, wherein the applicant requires a titanate selected from potassium titanate, calcium titanate, and barium titanate to be used as the fibrous filler. Watanabe et al. teaches the use of potassium titanate as the fibrous filler as shown above for claim 6. Thus, the limitations of claim 9 are met.

14. Regarding the limitations of claim 10, wherein the applicant require a borate selected from aluminum borate and magnesium borate to be used as the fibrous filler. Watanabe et al. teaches the use of aluminum borate as the fibrous filler as shown above for claim 7. Thus, the limitations of claim 10 are met.

15. Regarding the limitations of claim 12, wherein the applicant requires the base resin to further comprise powdery filler having an average particle size of 0.1-20 $\mu$ m. Watanabe et al. teaches the use of powdery inorganic filler such as talc, glass beads (silica), wollastonite, and calcium carbonate in the base resin composition. This powdery filler has an average diameter of 10 $\mu$ m or less (column 6, lines 35-43). As

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10 $\mu$ m is completely encompassed by the range specified by the applicant in claim 12, the limitations of claim 12 are met.

16. Regarding the limitations of claim 13, wherein the applicant requires spherical filler having an average particle size of 0.1-20 $\mu$ m. Although Watanabe et al. does not specifically teach that the filler powder is spherical, Watanabe et al. does teach the use of "glass beads" as the filler powder (column 6, lines 35-43). Webster's Dictionary, 10th edition 1998, defines "bead" as "a small ball-shaped body." Further, Webster's Dictionary, 10th edition 1998 defines "sphere" as "a globular body: **ball**." Thus, the examiner takes the position that glass beads are equivalent to glass spheres. Thus, the limitations of claim 13 are met when glass beads are chosen as the inorganic filler.

17. Regarding the limitations of claim 15, wherein the applicant requires aluminum borate to be used as the fibrous filler and silica to be used as the spherical filler.

Watanabe et al. teaches the use of aluminum borate as the fibrous filler as shown above for claim 1. Further, Watanabe et al. teaches the use of glass (silica) beads as the powdery filler material as shown above for claim 13. Thus, this limitation is met.

18. Regarding the limitations of claim 16, wherein the applicant requires the fibrous filler to have an average fiber diameter of 0.3-1 $\mu$ m and an average fiber length of 10-30 $\mu$ . Watanabe et al. teaches the use of a titanium oxide whisker as the fibrous filler, wherein the titanium oxide has an average fiber diameter between 0.1-0.5 $\mu$ m and an average fiber length of 1-20 $\mu$ m. These ranges overlap the ranges required by the applicant in claim 16. The examiner takes the position that it would have been obvious to one having ordinary skill in the art at the time the invention was made to change the



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fiber length and diameter within the specified range, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Thus, the limitations of claim 16 are met.

19. Regarding the limitations of claim 17, wherein the applicant lists suitable fibrous fillers. Watanabe et al. teaches the use of potassium titanate or aluminum borate as the fibrous filler. Thus, the limitations of claim 17 are met.

20. Claims 1-3, 5-6, and 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Inoue et al. (US4943606) in view of Swisher (US5480730).

21. Regarding the limitations of claim 1, wherein the applicant requires a laminate comprising a metal layer which is deposited on a substrate, wherein the substrate is activated by plasma treatment, and the substrate comprises a resin composition containing 20-150 parts by mass of a fibrous filler having an average diameter of 0.1-5 $\mu$ m and an average length of 10-50 $\mu$ m relative to 100 parts by mass of the base resin. Inoue et al. teaches a pre-preg composition for a circuit board that comprises 30-90% by weight liquid crystal polyester, 3-50% by weight of an inorganic fibrous or acicular material, and 3-30% by weight of an alkaline earth metal carbonate (column 2, lines 46-51). The liquid crystal is not amorphous but anisotropic even in a molten state (column 2, lines 53-55). Although Inoue et al. does not disclose that this liquid crystal is a melt type liquid crystal, because the liquid crystal polyester can exist in molten form, the examiner takes the position that this limitation is necessarily met. The fibrous inorganic material is typically selected from glass fibers, wollastonite and potassium titanate fibers

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(column 6, lines 33-46). The potassium titanate fiber has an ordinary fiber diameter between 0.1-1 $\mu$ m and a length between 10-120 $\mu$ m (column 6, lines 51-60), whereas the wollastonite fiber is listed as having an average diameter of less than 10 $\mu$ m, and an average length less than 50 $\mu$ m (column 12, lines 5-28). The average length of the potassium titanate or wollastonite fiber encompasses the range specified by the applicant. The examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time the invention was made to change the length and diameter of the fibrous material within the specified range, as it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. The resin composition can further comprise at least one thermoplastic resin in small amounts (column 8, lines 22-28). This composition can be formed into a molded article, which is then electrolessly plated with a metal (column 8, lines 29-36).

22. Inoue et al. does not teach plasma treating the surface of the molded resin article.

23. However, Swisher teaches that the adhesion of a metal layer to a resin material is improved if the surface of the resin is treated with a plasma prior to forming a thick metal layer on the resin (column 4, lines 3-14) via sputtering, vapor deposition, or electroless/electrolytic deposition (column 9, line 1-column 10, line 12). This treatment is suitable for resin materials including polyamides (nylons), polyesters, and polyphenylene ethers (column 6, lines 43-60), and is useful for enhancing the adhesion

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of metals such as aluminum, copper, gold, silver, etc... to these resins (column 7, lines 50-60).

24. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to treat the surface of the molded resin article taught by Inoue et al. with a plasma prior to depositing a metal layer on the resin, as taught by Swisher.

25. One would have been motivated to make this modification due to the teaching in Swisher et al. that the adhesion of a metal such as copper to a resin substrate such as polyester can be improved by plasma treating the resin substrate prior to depositing the metal layer. One would have further been motivated to make this modification due to the teaching in swisher that plasma deposition improves the adhesion of electrolessly deposited metals to resin substrates, and the teaching in Inoue et al. that the metal layer is deposited onto the resin substrate via electroless deposition.

26. Regarding the limitations of claim 2, wherein the applicant requires 1 or more resins having at least one bond or functional group selected from the group consisting of an amido bond, a sulfide group, a cyano group, an ester group, a sulfone group, a ketone group, and an imido group. Inoue et al. teaches the use of liquid crystal polyester as the base resin. Thus, an ester group must be present in the base resin. Therefore the limitations of claim 2 are met.

27. Regarding the limitations of claims 3 and 5, wherein the applicant requires a resin selected from the group consisting of nylon 46, nylon 11, nylon 6-10, nylon 12, nylon 6, nylon 66, poly(phthalamide), polyphenylene sulfide, poly(ether) nitrile, polyethylene terephthalate, polybutylene terephthalate, polysulfone, polyethersulfone,

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polyether ketone, polyetherimide, and melt-type liquid crystal polyester to be used in the base resin (claim 3), specifically melt-type liquid crystal polyester (claim 5). Inoue et al. teaches the use of melt-type liquid crystal polyester as the base resin as stated above for claim 1, thus the limitations of claims 3 and 5 are met.

28. Regarding the limitations of claim 6, 8, 9, and 17, wherein the applicant requires the fibrous filler to be a titanate (claim 6), specifically a potassium, calcium, or barium titanate (claim 9), wollastonite (claim 8), or any of the materials listed in claim 17, which include potassium, calcium, or barium titanate, and wollastonite. Inoue et al. teaches the use of potassium titanate and wollastonite as the fibrous filler materials. Thus, the limitations of claims 6, 8, 9, and 17 are met.

29. Regarding the limitations of claim 16, wherein the applicant requires the fibrous filler to have an average diameter of 0.3-1 $\mu$ m and an average length of 10-30 $\mu$ m. Inoue et al. as stated above for claim 1 teaches the use of potassium titanate as fibrous filler, wherein the potassium titanate has an average diameter of 0.1-1 $\mu$ m, and an average length of 10-120 $\mu$ m. The length range specified by Inoue et al. completely encompasses the range required by the applicant. The examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time the invention was made to change the length of the fibrous filler within the range specified by Inoue et al. as it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. Thus, the limitations of claim 16 are met.

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30. Claims 4 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al. as modified by Swisher as applied to claim 1 above, and further in view of Bersted et al. (US6207745).

31. Watanabe et al. as modified by Swisher fails to teach a laminate including polyphthalamide in the base resin, as required by claim 4. However, Watanabe et al. as modified by Swisher et al. does teach that additives such as flame-retardants may be added to the base resin (Watanabe, column 8, lines 63-66).

32. Further, Bersted et al. teaches a flame retardant anti-drip polyamide composition comprising a polyamide, a halogen containing organic compound, and an effective amount of an anti-drip component (column 1, lines 62-65). As the polyamide, a copolyamide such as a polyphthalamide is suitable for use (column 4, lines 22-41). These compositions exhibit excellent fire retardancy, heat resistance, rigidity, and impact strength, and can be molded into various articles via common molding techniques (column 9, lines 9-24). These materials are used in high temperature applications, such as in circuit boards and semi-conductor packaging (column 1, lines 12-20).

33. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute polyphthalamide as taught by Bersted et al. for the polyamide taught by Watanabe et al.

34. One would have been motivated to make such a modification due to the increase in heat resistance, fire resistance, rigidity, and impact resistance that one would expect to gain as a result.

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35. Regarding the limitations of claim 11, the combination of Watanabe et al. as modified by Swisher et al. with Bersted et al. results in a material that meets all of the limitations of claim 11.

36. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Inoue et al. as modified by Swisher et al. as applied to claim 1 above, and further in view of Freeman et al. (US5846309).

37. Inoue et al. as modified by Swisher fails to teach a laminate comprising a resin substrate impregnated with wollastonite as a fibrous material, and kaolin as a powdery filler, wherein the wollastonite has an average fiber diameter between 0.1-5 $\mu$ m, and an average fiber length between 10-50 $\mu$ m, and the kaolin has an average particle diameter between 0.1-20 $\mu$ m, as required by claim 14.

38. However, Inoue et al. does teach that a flame retardant may be incorporated into the base resin (column 8, lines 15-21).

39. Further, Freeman et al. teaches a method for manufacturing a coarse particle size kaolin clay which provides good reinforcement properties, and flame retardancy, when it is incorporated as a filler into polymer compounds (column 2, lines 55-60). The Kaolin clay taught by Freeman et al. has a particle diameter between 4.5-6  $\mu$ m (column 3, lines 10-20).

40. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate a kaolin clay having a particle size between 4.5-6 $\mu$ m as taught by Freeman et al. into the resin composition taught by Inoue et al.

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41. One would have been motivated to make such a modification due to the teaching in Freeman et al. that kaolin clay having the stated particle size improves the flame resistance of polymeric materials into which it is incorporated, and the teaching in Inoue et al. that flame-retardants may be added to the resin composition.

42. Claims 1, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okada et al. (US4798762) in view of Kobayashi et al. (US6197149), further in view of Machii et al. (US6025056).

43. Regarding the limitations of claims 18 and 19, wherein the applicant requires a laminate having a core layer containing no fibrous filler and a superficial layer containing fibrous filler (claim 18), wherein the core layer contains powdery filler (claim 19). Okada et al. teaches a copper clad laminate board that comprises a center plate (equivalent to applicants claimed core) sandwiched between fiber reinforced layers (equivalent to applicants claims superficial layer), wherein the outer surface of the fiber reinforced layers are covered by copper foils. The center plate and reinforcing layers both comprise a resin, with the center plate further containing a uniformly distribute filler (equivalent to applicants claimed powdery filler) (Column 2, lines 15-25, column 3, lines 19-21, figure 1). Thermosetting resins such as epoxies can be used for both the center plate and the fiber reinforced layer (column 3, lines 13-19). The filler material used in the center plate is typically selected from hollow microspheres formed from materials such as alumina, silica, zirconia, glass, carbon, and phenol resin (column 23-31). The fiber used to reinforce the fiber reinforced layer is typically glass cloth, and Okada et al. teaches a specific example utilizing a glass cloth reinforced epoxy as the fiber

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reinforced layer (column 4, lines 4-6). A copper clad laminate formed by sandwiching a center plate between two layers of glass fiber reinforced epoxy, sandwiching the resulting article between two layers of copper foil, and bonding the foil with the application of heat and pressure process (column 4, lines 8-10) It should be noted that the purpose of the Okada et al. laminate is to achieve a circuit board that is increased in rigidity, as well as other properties (column 1, lines 41-59).

44. Okada et al. fails to teach a laminate having a core layer containing a powdery filler and superficial layer containing a fibrous filler, wherein the superficial layer comprises a resin material is activated by plasma treatment, contains 20-150 parts by mass of a fibrous filler having an average fiber diameter of 0.1-5 $\mu$ m, and an average fiber length of 10-50 $\mu$ m, as required by claim 1.

45. However, Kobayashi et al. teaches that glass cloth impregnated epoxies have particular disadvantages when used as fiber reinforced layers (pre-pregs) in circuit boards. In particular, glass reinforced epoxies are shown to exhibit a tendency to warp and exhibit irregular dimensional change after hot pressure molding (column 2, lines 1-13). Kobayashi et al. teaches a material for use a fiber reinforced layer ins a circuit board that avoids the problems of the prior art, while simultaneously providing excellent electrical insulation properties (column 3, lines 39-42). The material taught by Kobayashi et al. is comprised of a base resin that contains electrically insulating whiskers (column 4, lines 15-20). In particular, the base resin used in the material taught by Kobayashi et al. is typically selected from many materials, including epoxies (column 7, lines 52-67). The whiskers contained in the base resin have an average



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diameter between .3-3 $\mu$ m, an average fiber length of 3-50 $\mu$ m, and are typically manufactured from materials such as potassium titanate, aluminum borate, and wollastonite (column 5, line 45-column 6, line 25). The amount of whiskers in the resin is typically between 5-350 parts by weight (column 8, lines 59-67), with 30-230 parts by weight being preferred (column 9, lines 5-8).

46. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to substitute the fiber reinforced material taught by Kobayashi et al. for the fiber reinforced material taught by Okada et al.

47. One would have been motivated to make such a modification due to the teaching in Kobayashi et al. that fiber reinforced materials such as those used in Okada et al. tend to warp or bend after hot pressure molding, the teaching in Kobayashi et al. that a fiber reinforced material containing 10-350 part by weight of a fiber having an average diameter between 0.3-3 $\mu$ m and an average length between 3-50 $\mu$ m avoids the warpage problem of the prior art. One would have been further motivated due to the teaching in Okada et al. of the desirability of a rigid circuit board that does not warp.

48. Regarding the limitation in claim 1 wherein the applicant requires the surface of the material to be adjacent to a metal foil to have been activated by plasma treatment. Machii et al. teaches that plasma treating a resin material such as polyester is known to increase the adhesion of a metal layer to the resin via heat bonding (column 8, lines 42-59).

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49. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to plasma treat the surface of the fiber reinforced layer taught by Okada et al. as modified by Kobayashi et al. as taught by Machii et al.

50. One would have been motivated to make this modification due to the teaching in Machii et al. that the adhesion of a metal sheet laminated to a resin material can be improved by plasma treating the resin layer.

51. Claims 1, and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Inoue et al. in view of Kobayashi et al. (US6197149), further in view of Matsushita (JP53-62175), further in view of Swisher.

52. With respect to the limitations of claim 1, Inoue et al. teaches all of the required limitations except for the required plasma activation step as set forth above. It should also be noted that the resin composition taught by Inoue et al. is directed at forming a circuit board which exhibits improved resistance to warpage (column 2, lines 15-24)

53. With respect to the limitations of claims 20-22, Inoue et al. fails to teach a laminate comprising a plurality of resin layers containing a resin filler (claim 20), wherein the orientation of the resin filler is different between adjacent layers (claim 21), specifically where the fiber orientation is orthogonal between layers (claim 22).

54. However, with respect to the limitations of claim 20, Kobayashi et al. teaches a resin composition for forming a multilayer circuit board, wherein the resin composition comprises a base resin mixed with insulating whiskers (column 4, lines 15-21). The base resin taught by Kobayashi et al. can be formed from many materials, including polyesters (column 7, lines 53-67). The insulating whiskers are typically made of

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aluminum borate, wollastonite, or potassium titanate, and have a average diameter between 0.3-3 $\mu$ m, and an average length between 3-50 $\mu$ m (column 6, lines 17-25). This composition is used to form an insulating layer in a multilayer circuit board. Last, Kobayashi et al. teaches that the insulating fibers are preferentially oriented parallel to the plane forming the insulating material layer. This orientation is essential to forming a multilayer circuit board having high rigidity (column 9, lines 20-30).

55. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to form a multilayer circuit board with the insulating resin composition taught by Inoue et al. Further, it would have been obvious to one having ordinary skill in the art at the time the invention was made to orient the fibrous filler in Inoue et al. as taught by Kobayashi et al.

56. One would have been motivated to form a multilayer circuit board out of the composition of Inoue et al. due to the teaching in Kobayashi et al. that the formation of a multilayer circuit board utilizing an insulating resin composition that comprises the same type of base resin (polyester) and the same type of fibrous filler (potassium titanate, aluminum borate etc.), as that taught in Inoue et al. is known. One would have been motivated to orient the fibrous filler of Inoue et al. due to the teaching in Kobayashi et al. that orienting the fibrous filler improves the rigidity of the resulting circuit board, and the teaching in Inoue et al. of the desirability of a circuit board that has resistance to warpage, which is directly related to rigidity.

57. With respect to the limitations of claims 21-22, Matsushita et al. teaches that by orienting the fibrous filler of 2 adjacent layers in a printed circuit board orthogonal

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(perpendicular) to one another, a circuit board having good warp-resistance and dimensional stability can be formed (abstract).

58. Therefore it would have been obvious to one of ordinary skill in the art in the art at the time the invention was made to orient the fibrous filler in adjacent layers of the multilayer circuit board taught by Inoue et al. as modified by Kobayashi et al. perpendicular to one another, as taught by Matsushita et al.

59. One would have been motivated to make such a modification due to the teaching in Matsushita et al. that a multilayer circuit board having good warp resistance can be formed if the fibrous filler in one layer is oriented perpendicular to the fibrous filler in an adjacent layer. Further, one would have been motivated to make this modification due to the teaching in Inoue et al. of the desirability of a circuit board having good warp resistance.

60. With respect to the limitations of claim 1, wherein the applicant requires the insulating substrate to be activated by plasma treatment prior, Swisher teaches that the adhesion of a metal layer to a resin material is improved if the surface of the resin is treated with a plasma prior to forming the a thick metal layer on the resin (column 4, lines 3-14) via sputtering, vapor deposition, or electroless/electrolytic deposition (column 9, line 1-column 10, line 12). This treatment is suitable for resin materials including polyamides (nylons), polyesters, and polyphenylene ethers (column 6, lines 43-60), and is useful for enhancing the adhesion of metals such as aluminum, copper, gold, silver, etc... to these resins (column 7, lines 50-60).

61. Therefore it would have been obvious to plasma treat the surface of the multilayer substrate taught by Inoue et al. as modified by Kobayashi et al. and Matsushita et al., as taught by Swisher.

62. One would have been motivated to make such a modification due to the teaching in Swisher that the adhesion of a metal coating such as copper to a substrate such as a polyester is improved by plasma treating the substrate prior to forming the copper layer. One would have been further motivated to make this modification due to the teaching in Inoue et al. that the copper layer is formed via electroless or electrolytic deposition, and the teaching in Swisher that the plasma treating step is particularly suited to enhance the adhesion of metal coatings which are deposited in this manner.

### ***Response to Arguments***

63. Applicant's arguments with respect to claims 1-15 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.


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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0389.

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nju

October 10, 2002

  
**STEVAN A. RESAN**  
**PRIMARY EXAMINER**